CLAIMS

What is claimed is:

1. A PIN photodetector comprising:

a first semiconductor contact layer;

a semiconductor absorption layer, the first semiconductor contact layer having a smaller area than the semiconductor absorption layer;

a semiconductor passivation layer positioned between the first semiconductor contact layer and the semiconductor absorption layer; and

a second semiconductor contact layer, the semiconductor absorption layer and passivation layers being positioned between the first and second semiconductor contact layers.

2. The photodetector of claim 1 wherein the semiconductor absorption layer is InGaAs.

3. The photodetector of claim 1 wherein the passivation layer is InAlAs.

4. The photodetector of claim 1 wherein the wherein the first semiconductor contact layer is a p-type and the second semiconductor contact layer is an n-type.

5. The photodetector of claim 1 wherein the wherein the first semiconductor contact layer is an n-type and the second semiconductor contact layer is a p-type.

6. The photodetector of claim 5 wherein the first and second semiconductor contact layers are InAlAs.

7. The photodetector of claim 1 further comprising a second semiconductor passivation layer positioned about the first semiconductor passivation layer and the semiconductor absorption layer.

8. The photodetector of claim 1 further comprising a first metal contact positioned adjacent to the first semiconductor contact layer and at least one second metal contact positioned adjacent to the second semiconductor contact layer.

9. The photodetector of claim 8 wherein the first metal contact is a p-type and the second metal contact is an n-type.

10. The photodetector of claim 8 wherein the first metal contact is an n-type and the second metal contact is a p-type.

11. The photodetector of claim 1 further comprising a first bandgap grading layer positioned between the semiconductor passivation layer and the semiconductor absorption layer and a second bandgap grading layer positioned between the semiconductor absorption layer and the second semiconductor contact layer.

12. The photodetector of claim 1 wherein the electric field near the center of the semiconductor absorption layer is greater than the electric field near the edges of the semiconductor absorption layer.

13. The photodetector of claim 1 wherein the capacitance of the photodiode is determined by the area of the first semiconductor contact layer.

14. The photodetector of claim 1 wherein the photodiode has a dark current behavior that is substantially constant relative to an initial value.

15. The photodetector of claim 14 wherein the photodiode has a dark current behavior that is substantially constant relative to an initial value over a time period greater than 2000 hours.

16. The photodetector of claim 1 wherein the photodiode has a lifetime that exceeds twenty years.

17. The photodetector of claim 1, where other semiconductors such as InP or other binary or tertiary III-V semiconductors are used.

18. A method of fabricating a PIN photodetector comprising:

providing a lower semiconductor contact layer;

depositing a semiconductor absorption layer;

depositing a semiconductor passivation layer; and

depositing or fabricating an upper semiconductor contact layer having a smaller area than the semiconductor absorption layer.

19. The method of claim 18 wherein the semiconductor absorption layer is InGaAs.

20. The method of claim 18 wherein the passivation layer is InAlAs.

21. The method of claim 18 wherein the wherein the lower semiconductor contact layer is an n-type and the upper semiconductor contact layer is a p-type.

22. The method of claim 18 wherein the wherein the lower semiconductor contact layer is a p-type and the upper semiconductor contact layer is an n-type.

23. The method of claim 22 wherein both semiconductor contact layers are InAlAs.

24. The method of claim 18 further comprising depositing a second semiconductor passivation layer about the first semiconductor passivation layer and the semiconductor absorption layer.

25. The method of claim 18 further comprising depositing a first grading layer between the lower semiconductor contact layer and the semiconductor absorption

layer and depositing a second grading layer between the semiconductor absorption layer and the semiconductor passivation layer.

26. The method of claim 18 using other semiconductors such as InP or other binary or tertiary III-V semiconductors.